

Referee Report on

“Endogenous technology sharing in R&D intensive industries” by Derek J. Clark and Jan Yngve Sand

This paper contributes to the literature endogenous formation of technology sharing coalitions in concentrated markets. In particular, it proposes a three firms endogenous mergers game where firms compete la Cournot in the product market and where costs may be reduced via R&D spending. This spending is individually done by each firm but they can share the results by forming technology sharing coalitions.

In this model firms have ex-ante asymmetric costs of production, and becoming more efficient requires investment.

The model the authors consider is simple, and allows studying all possible coalitional structures of the game in a simple set-up: Research investment, costs, production level, profits. The paper also shows the rank of welfare for different coalitional arrangements, in particular that, in case a consumers-surplus-maximizing authority will prefer the two most efficient firms to form a coalition.

The model is well solved and the results clearly presented.

Even though the paper addresses an interesting research topic in industrial organization, I find the model too specific and some of its assumptions too strong to be convinced. Let me explain my view in more detail.

Main Comments:

1. My first concern regards the specific assumptions the author include in the model:

(1.a) for example the cost asymmetry that the authors consider and the specific cost function used. These assumptions allow to well-defined conceptually a coalition in a Cournot model. Expressions are extremely simple and help solving the model but one may wonder how robust the results are to other assumptions. For example, the asymmetry on firms costs is very symmetric. Can the authors say something on a more asymmetric situation were marginal costs are $c(1)=0$, $c(2)=c$, $c(3)=k*c$?

Another possibility is to assume that firms are ex-ante symmetric in the production costs, but have asymmetric costs on R&D.

(1.b) In the model, it is assumed that each firm decides non-cooperatively the level of output and the R&D expenses in any coalitional structure. The only commitment a coalition makes is that the technology improvements will be shared within the coalition (total spillovers). This ability to commit to share the results but not to decide jointly the R&D expenses needs much more discussion.

(1.c) The expenditures on R&D have convex costs and when R&D results are shared the costs are reduced in the sum of the efforts (there are no duplication or they are perfect substitutes). What would have happened if the costs were not quadratic or if spillovers were smaller?

(1.d) The authors assume zero fixed costs in the R&D process. So, a natural question one can ask is what happens in a more realistic setting where coalitions affect firms fixed costs of doing R&D?

(1.e) By restricting attention to a three firm model, the authors rule out the analysis of more fragmented situations than triopoly. This is, in my opinion, a key assumption of the model which should be discussed in detail. I understand this assumption simplifies the analysis, but the authors should make an effort to try and convince the reader that the results still hold when one considers a situation where initially there are more than three firms (may be all of them belonging to the three types of firms that the authors consider).

(1.f) It is not clear that in the real world, when sharing knowledge, all firms have the same opportunity to absorb the knowledge created by another firm. This may depend on the initial technology. It may also be the case that when sharing technology the most efficient firm ex-ante is not able to protect its technology from its partner, and this partner absorbs more than just $x(1)$.

I think that the authors need to think through this issue of robustness and provide, at least, a discussion of it at the end of the paper.

2. I am also concerned with the proposed stability concept. A very important problem linked to coalition stability concepts is the understanding of what happens to those coalitions from which (deviant) players depart: do they fall apart or do the remaining players belonging to those coalitions still stick together? It has repeatedly said that there is no correct answer to this problem. The two main views adopted in the literature are the stability based on the assumption that if some players leave, the agreement breaks down and the rest of the members become singletons, while other authors consider that if a player leave a coalition the others will remain together. In this paper, the authors, decided to follow Horn and Persson approach. It would be nice to justify this choice and to discuss how it affects the results.

3. There are some related paper that may be interesting to mention. Among others, the authors may want to refer to:

Barros, 1998. *Econ Letters* 60, 113-119.

Goyal and Moragas, 2001. *Rand J. of Econ.* 32, 686-707.

4. Some of the computations for different coalitional structures are very similar and can be presented in a more condensed way.